

3. Elasticity of Demand and Its Measurement

Price elasticity of demand is generally defined as the responsiveness or sensitiveness of demand for a commodity to the changes in its price. More precisely, *elasticity of demand is the percentage changes in demand as a result of one per cent in the price of the commodity.*

Firms may have decided to change the price even without any change in the cost of production but whether rising price following the rise in cost or otherwise proves beneficial depends on :

- (a) The price elasticity of demand for the product i.e. how high or low is the proportionate change in its demand in response to a certain percentage change in its price.
- (b) Price elasticity of demand for its substitute because when the price of product increase the demanded for its substitute increases automatically even if their prices remain unchanged.

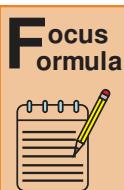
Concept of Price Elasticity of Demand



Price Elasticity of Demand

Price Elasticity of Demand is generally define as the responsiveness or sensitiveness of demand for a commodity to change in its price. *More precisely elasticity of demand is the percentage change in demand as a result of one percentage in the price of commodity.*

A formal definition of price-elasticity of demand (e_d) is given as :



$$e_d = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$$

$$\text{Price elasticity of demand} = \frac{\Delta Q / Q}{\Delta P / P}$$

Where Q = Original Quantity Demanded

P = Original Price

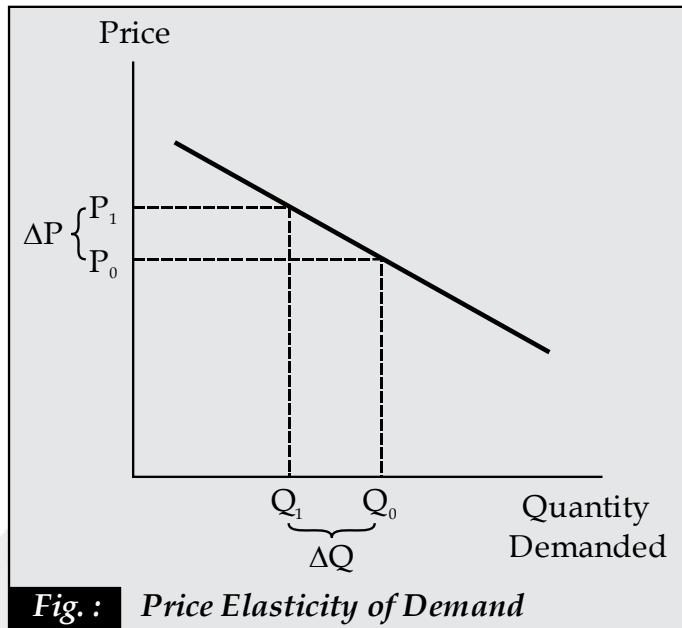
ΔQ = Change in Quantity Demanded

and ΔP = Change in Price

For example, if the price of a daily newspaper increases from Rs. 1.00 to Rs. 1.20, and the daily sales falls from 500,000 to 250,000, the PED will be

$$= - \left(\frac{5,00,000 - 2,50,000}{5,00,000} \right) \times \left(\frac{1.00}{1.20 - 1.00} \right)$$

$$= (-) 2.5$$



The price elasticity of demand is the proportional change in the quantity demanded, relative to the proportional change in the price of the good.

Income Elasticity of Demand

Income elasticity of demand measures the responsiveness of quantity demanded to a change in income. *It is measured by dividing the percentage change in quantity demanded by the percentage change in income.* If the demand for a commodity increases by 20% when income increases by 10% then the income elasticity of that commodity is said to be positive and relatively high.



$$E_y = \frac{\% \text{ change in quantity demanded of } A}{\% \text{ change in income}}$$

$$\text{Income elasticity of demand} = \frac{\Delta Q / Q}{\Delta I / I}$$

The following are the various types of income elasticity:

- **Zero Income Elasticity** : The increase in income of the individual does not make any difference in the demand for that commodity. ($E_i = 0$)
- **Negative Income Elasticity** : The increase in the income of consumers leads to less purchase of those goods. ($E_i < 0$).
- **Unitary Income Elasticity** : The change in income leads to the same percentage of change in the demand for the good. ($E_i = 1$).
- **Income Elasticity is Greater than 1** : The change in income increases the demand for that commodity more than the change in the income. ($E_i > 1$).
- **Income Elasticity is Less than 1** : The change in income increases the demand for the commodity but at a lesser percentage than the change in the Income. ($E_i < 1$).

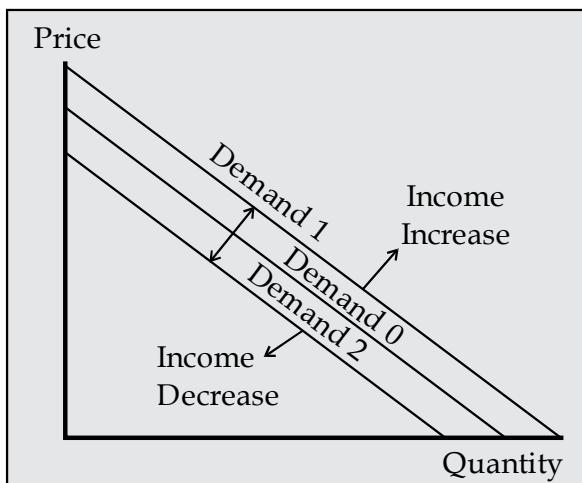


Fig. : Income Elasticity of Demand

The income elasticity of demand is the proportional change in the quantity demanded, relative to the proportional change in the income.

Cross Elasticity of Demand

The cross-elasticity is the measure of responsiveness of demand for a commodity to the changes in the price of its substitutes and complementary goods. For instance, cross-elasticity of demand for tea is the percentage change in its quantity demanded with respect to the change in the price of its substitute, coffee.

Focus Formula



Cross Elasticity of Demand

$$E_{A,B} = \frac{\% \text{ change in quantity demanded of } A}{\% \text{ change in price of product } B}$$

Cross Price Elasticity

$$\begin{aligned} E_{xy} &= \frac{Q_{x_2} - Q_{x_1}}{\frac{Q_{x_1}}{\frac{P_{y_2} - P_{y_1}}{P_{y_1}} \times 100}} \\ &= \left(\frac{Q_{x_2} - Q_{x_1}}{Q_{x_1}} \right) \times \left(\frac{P_{y_1}}{P_{y_2} - P_{y_1}} \right) \end{aligned}$$

$$= \frac{\Delta Q_x}{\Delta P_y} \times \frac{P_{y_1}}{Q_{x_1}}$$

or

$$= \frac{\Delta Q_x}{Q_{x_1}} \times \frac{P_{y_1}}{\Delta P_y}$$

where $E_{xy} > 0$ Substitutes (+/+ or -/-)

$E_{xy} < 0$ Complements (+/- or -/+)

$E_{xy} = 0$ Unrelated goods (0/+ or 0/-)


**DID YOU
KNOW ?**

- A positive cross elasticity of demand means that the products are substitute goods.
- A negative cross elasticity of demand means that the products are complementary goods.
- A near zero cross elasticity of demand means that the products are independent goods i.e. quantity demanded of product A is not affected by any movement in price of product B.

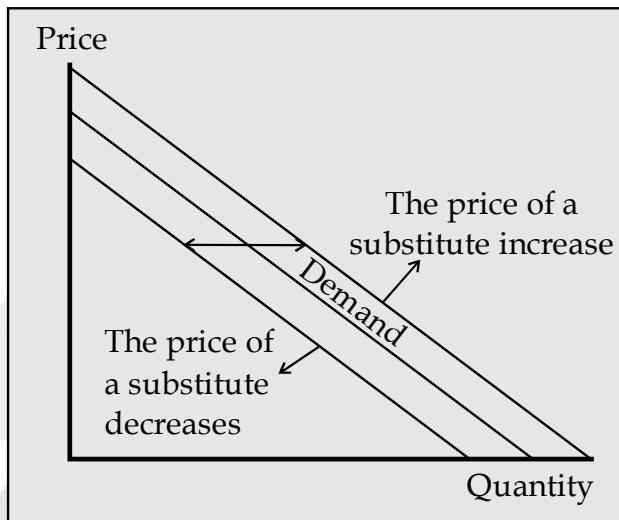


Fig. : Cross Elasticity of Demand

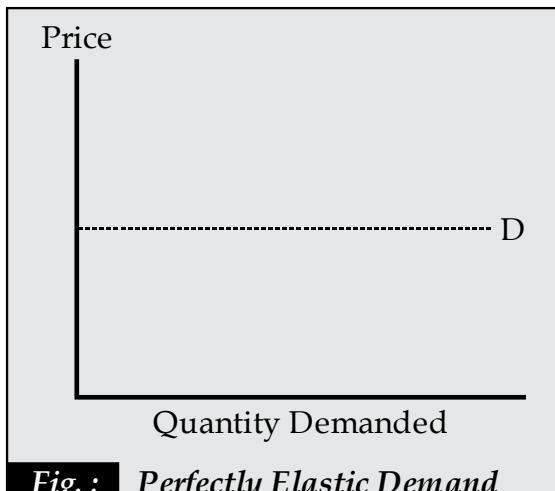
The cross elasticity of demand is the proportional change in the quantity demanded, relative to the proportional change in the price of another good. Looking at the chart, the change in the price of another good shifts the demand curve to the left or to the right.

- If the two goods are substitutes, the cross elasticity of demand is positive.
- If the two goods are complements, the cross elasticity of demand is negative.

Degree's of Elasticity of Demand

(i) **Perfectly Elastic Demand ($e_d = \infty$)** : In a market that has perfectly elastic demand for a product, even a small change in price causes an infinite change in the quantity demanded. Like wisely a very insignificant rise in price is reduces in zero. This case is theoretically which never found in real life.

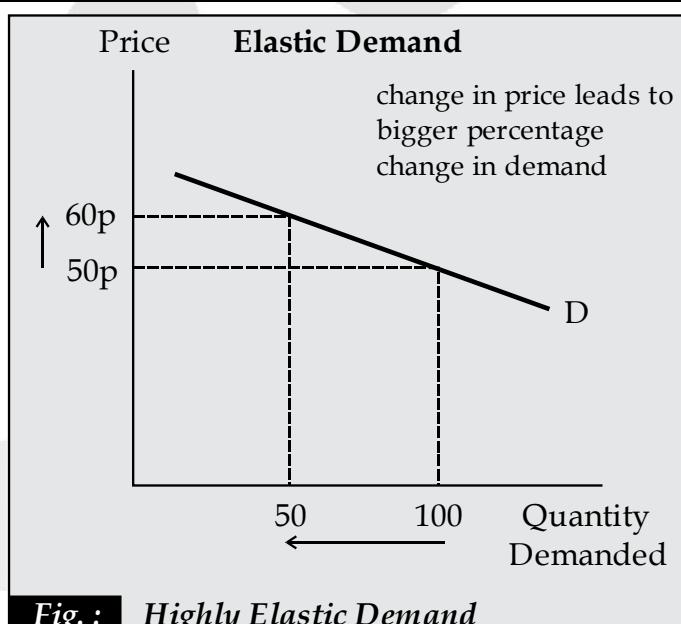
Perfectly Elasticity of Demand	
Price	Demand (Qty.)
10	100
10	110
10	120



(ii) Highly Elastic Demand ($e_d > 1$) : *The demand is relatively more elastic when small change in price cause a greater change in quantity of demand. In such case proportionate change in price of commodity cause more than proportionate change in quantity of demand.*

- If income goes up 10%, and you spend 20% more on foreign holidays. The $e_d = 2.0$ (luxury goods) ($e_d > 1$).
- If income goes up 10%, and you spend 5% less on Tesco value baked beans. The $e_d = -0.5$ (inferior good) ($e_d < 0$).

Highly Elasticity of Demand	
Price	Demand (Qty.)
50	100
60	50



(iii) Unitary Elastic Demand ($e_d = 1$) : *The demand is said to be unit when a change in price result in exactly the same percentage change in quantity demanded of a commodity. In such situation the percentage change in both price and quantity demanded is the same. For example if the price falls by 25% the Quantity of demanded rise by the same 25%.*

Elasticity of Demand	
Price	Demand (Qty.)
10	100
8	125
6	167

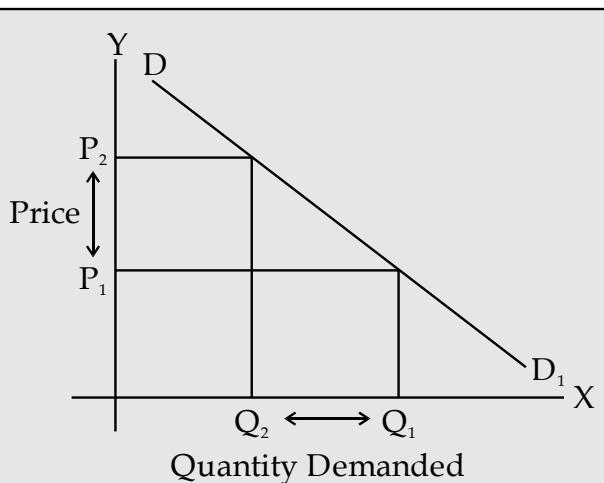


Fig. : Unitary Elastic Demand

Observe the graph, price of the goods increased from P_1 to P_2 and eventually the demand for the goods decreases from Q_1 to Q_2 . The proportionate change in price is equal to the proportionate change in demand.

(iv) **Less Elastic Demand or Relatively Inelastic Demand ($e_d < 1$)** : *Where a greater change in price leads to smaller change in Quantity demanded.* The demand is said to relatively inelastic when a proportionate change in price is greater than the proportionate change in quantity demanded. For example if price increase by 10% than quantity demand is less than by 2%.

Less Elasticity of Demand	
Price	Demand (Qty.)
10	100
8	102
6	103

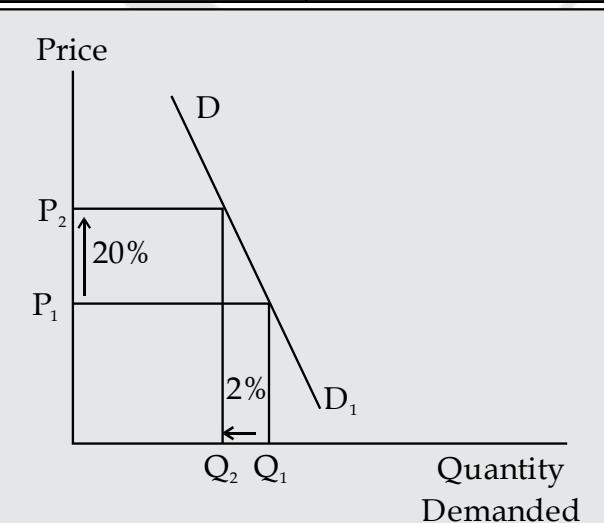
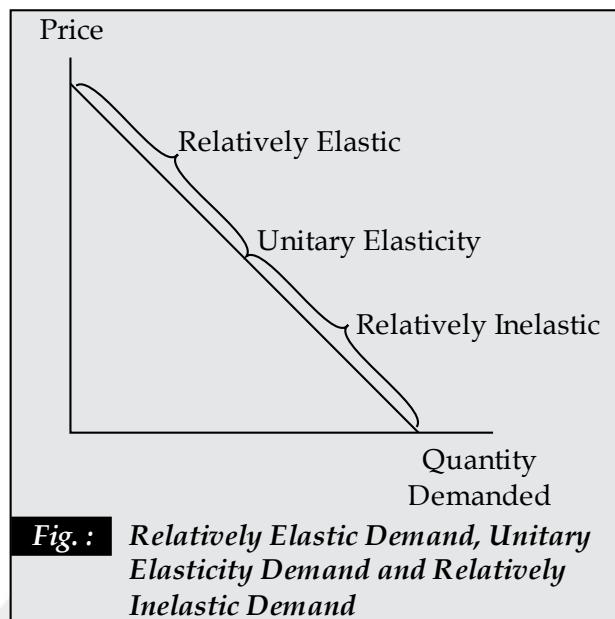


Fig. : Less Elastic Demand

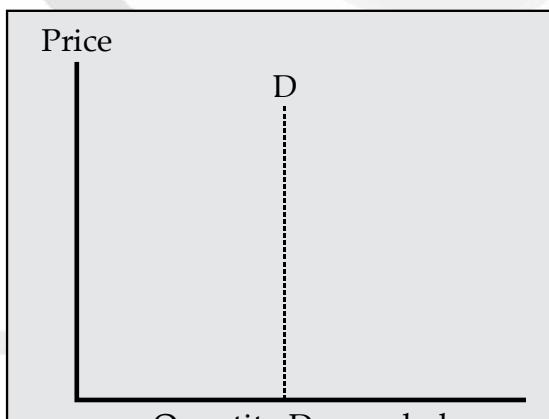
Relatively Elastic Demand, Unitary Elasticity Demand and Relatively Inelastic Demand



- Relatively elastic demand: The elasticity is between -1 and $-\infty$.
- Unitary elasticity demand: The elasticity is -1 .
- Relatively inelastic demand: The elasticity is between 0 and -1 .

(v) **Perfectly Inelastic Demand ($e_d = 0$)** : *The demand is said to be perfectly inelastic when a change in price produces no changes in the quantity of demanded of a commodity.* In such case quantity of demand remains constant regardless change in price. The amount of demand is totally unresponsive changes in price. The elasticity of demand is zero.

Perfect Inelasticity of Demand	
Price	Demand (Qty.)
10	100
8	100
6	100



Price Elasticity	Relation	Significance
Perfect Elasticity	$e_d = \infty$	Small change in price causes an infinite change in the quantity demanded.
Highly Elasticity of Demand	$e_d > 1$	Proportionate change in price of commodity cause more than proportionate change in quantity of demand.
Unitary Elastic Demand	$e_d = 1$	change in price result in exactly the same percentage change in quantity demanded of a commodity
Less Elastic Demand or Relatively Inelastic Demand	$e_d < 1$	Demand is said to relatively inelastic when a proportionate change in price is greater than the proportionate change in quantity demanded.
Perfectly Inelastic Demand	$e_d = 0$	Change in price produces no changes in the quantity of demanded of a commodity.
Cross Elasticity	Relation	Significance
Perfect Substitutes	$e_d = \infty$	The smallest possible increase (decrease) in the price of one good cause an infinity large increase (decrease) in the Qty. of demanded of the other goods.
Substitute	$0 < e_d < \infty$	If the price of one goods increases or decreases the Qty. of demanded of other goods also increases or decreases.

Income Elasticity	Relation	Significance
Income elastic	$e_d > 1$	Proportionate change in price of Qty. cause more than proportionate change in income
Income Inelastic (Normal Goods)	$0 < e_d < 1$	when a proportionate change in income is greater than the proportionate change in quantity demanded.
Negative Income elastic (Inferior Goods)	$e_d < 0$	The qty. of demanded of one good decreases or increases when the income of the other goods increases or decreases.

Methods of Measurements of Price Elasticity of Demand

1. Proportionate or Percentage Method of Flux : This method also known as the Percentage Method, Flux Method, Ratio Method, and Arithmetic Method is also associated with the name of Dr. Marshall. According to this method, "Price elasticity of demand is the ratio of percentage change in the amount demanded to the percentage change in price of the commodity."

Focus Formula

Proportionate or Percentage Method of Flux

$$e_d = \frac{\% \text{ Change in Quantity Demanded}}{\% \text{ Change in Price}}$$

$$e_d = \frac{\% \Delta Q}{\% \Delta P}$$

$$e_d = \frac{(Q_1 - Q) / Q}{(P_1 - P) / P}$$

Suppose Ram is selling 50 candles for 50 Rs. You find that decrease of 10 Rs. increases the demand for 60. What would be the price elasticity of demand?

$$e_d = ((60 - 50) / 50) / ((40 - 50) / 50)$$

$$e_d = 0.2 / -0.2 = -1$$

$$e_d = 1$$

2. Point Method : Graphic method is otherwise known as point method or Geometric method. This method was popularized by method. According to this method elasticity of demand is measured on different points on a straight line demand curve. The price elasticity of demand at a point on a straight line is equal to the lower segment of the demand curve divided by upper segment of the demand curve.

This method is explained with the help of (A) straight line demand curve and (B) convex demand curve.

(A) Straight Line Demand Curve : The diagram shows a straight line demand curve. We join both sides of the straight line demand curve with the two axes at points D and C. Elasticity at any points is equal to the ratio of the distance from the point P to the X axis and the distance to the Y axis.

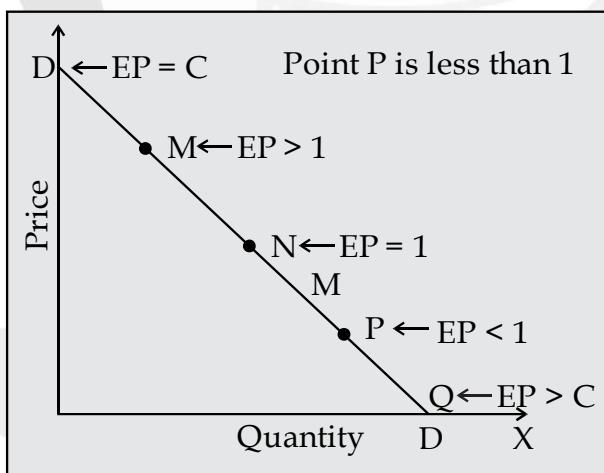
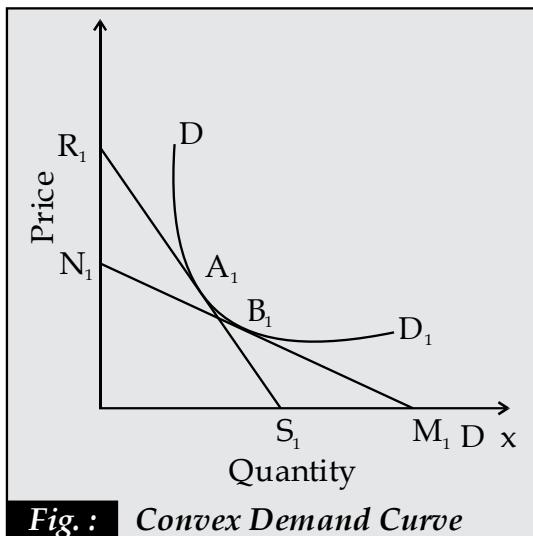
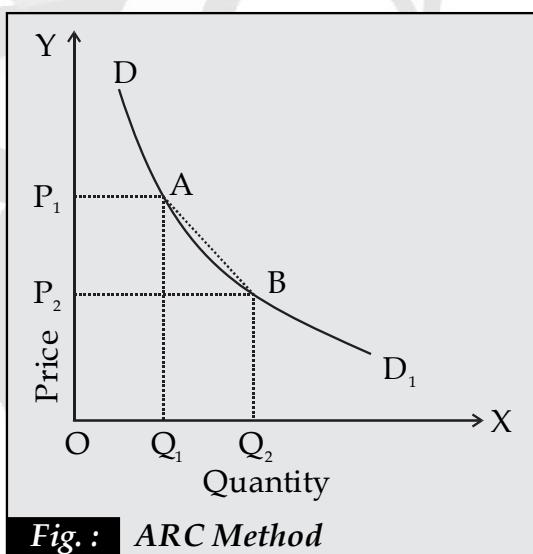


Fig. : Straight Line Demand Curve

(B) Convex Demand Curve : There is convex demand curve DD. Suppose we want to check price elasticity at point A. We can draw a tangent RS at the point A. The elasticity is found as AM / AR. Similarly for finding out elasticity at point B we draw a tangent at this point to the demand curve. The elasticity at this point is given by the ratio of the distance along the tangent to the X-axis divided by the distance of the Y-axis.



3. ARC Method : Arc elasticity of demand measures elasticity between two points on a curve. On most curves the elasticity of a curve varies depending upon where you are. Therefore elasticity needs to measure a certain sector of the curve. "**Arc elasticity is a measure of the average responsiveness to price change exhibited by a demand curve over some finite stretch of the curve**" Prof. Baumol.



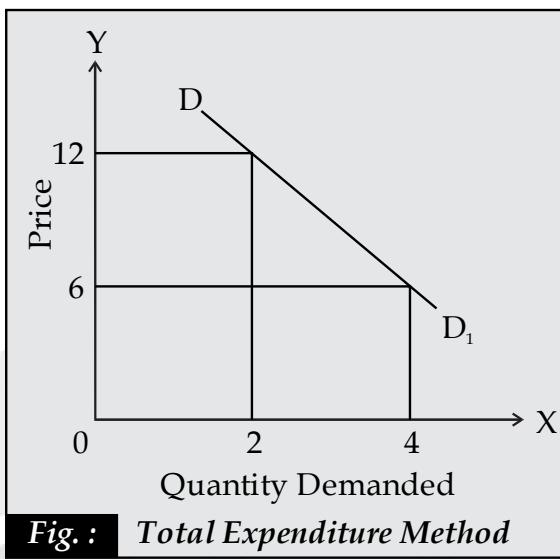
4. Total Expenditure Method : Total expenditure method was formulated by Alfred Marshall. The elasticity of demand can be measured on the basis of change in total expenditure in response to a change in price. It is worth noting that unlike percentage method a precise mathematical coefficient cannot be determined to know the elasticity of demand.

By the help of total expenditure method we can know whether the price elasticity is equal to one, greater than one, less than one. In such a method the initial expenditure before the change in price and the expenditure after the fall in price are compared. By such comparison, if it is found that the expenditure remains the same, elasticity of demand is One ($e_d = 1$).

If the total expenditure increases the elasticity of demand is greater than one ($e_d > 1$). If the total expenditure diminished with the change in price elasticity of demand is less than one (e_d).

Schedule for Expenditure Elastic Demand

Price	Quantity Demand	Outlay
12	2	24
6	4	24
3	8	24



5. Revenue Method : Revenue Method Mrs. Joan Robinson has given this method and elasticity of demand is measured with the help of average revenue and marginal revenue. Therefore, sale proceeds that a firm obtains by selling its products are called its revenue. However, when total revenue is divided by the number of units sold, we get average revenue.

Determinants of Price Elasticity of Demand

1. The Availability of Close Substitutes : If a product has many close substitutes, for example, cold drink, then people tends to react strongly to a price increase of one firm's cold drink. Thus, the price elasticity of demand of this firm's product is high. The more the number of substitutes of the good, higher is likely to be the e_d of that good. This is so because the consumer can easily shift from one substitute to another in case of price change.

2. The Importance of The Product's Cost in One's Budget : If a product, such as salt, is very inexpensive, consumers are relatively indifferent about a price increase. Therefore, salt has a low price elasticity of demand. Cars are expensive and a 10% increase in the price of a car may make the difference whether people will choose to buy the car or not. Therefore, cars have a higher price elasticity of demand. Higher the proportion of income of consumer spends on a good, higher is the e_d of that good and vice versa.

3. Number of uses of The Good : More the number of uses of a good more likely are to be the Ed of that good. For example electricity has many uses and can be used for lighting, heating, cooling etc. so the demand for electricity is more elastic as any increase in electricity charges will reduce the demand for it because consumer will use it only for heating and not for heating and cooling.

4. Income of Consumer : Richer the consumer, more likely the demand for a good by him is less elastic. A rich consumer is less likely to reduce consumption of a good when its price rises.

5. How High The Price of The Good : Higher the price of the good, higher is the elasticity. It is so because a change in price of a high priced good affects the total budget significantly.

6. Nature of The Good : The elasticity of demand also depends on the nature of commodity or how important or necessary the good is for the consumer. In case of essential goods like salt, kerosene oil or match box or wheat or rice the demand will be less than unitary elastic i.e. inelastic. In case of luxury goods like air-conditioner, costly TV or furniture, gold etc. the demand will be more than unitary elastic i.e. elastic.

However, in case of comfort goods like fans, coolers, heaters etc., the demand will be unitary elastic. It is a matter of habit also. If the consumer is habitual to a certain product like liquor or cigarettes etc., he is less likely to shift to other goods in case of rise in price of the good thus demand for these products are inelastic.

7. The Period of Time under Consideration : Price elasticity of demand is greater if you study the effect of a price increase over a period of three years rather than one week. Over a longer period of time, consumers have more time to adjust to the price change. If the price of petrol increases considerably, buyers may not decrease their consumption much after one week. However, after three years, they have the ability to move closer to work or school, arrange carpools, use public transportation, or buy a more fuel-efficient vehicle.

8. Joint Demand : Goods demanded jointly have inelastic demand than demanded separately. For example car and petrol pen and ink and camera and film, house and cement. Rise in price of cement may not contract its demand if there is no fall in the demand for houses.

9. Time Elapsed since a Price Change : The longer the time that has elapsed since a price change, the more elastic is demand.

Ques. Match the items of List-I with the items of List-II.

(NTA UGC-NET June 2014 P-II)

List-I

- | | |
|---|---------------------------|
| (a) A market having high price elasticity. | (i) Skimming pricing |
| (b) A market having high price inelasticity | (ii) Differential pricing |
| (c) A market having several segments differing prominently with regard to price elasticities of their demand. | (iii) Penetrating pricing |

List-II

Codes :

- | | | |
|-----|------|-------|
| (a) | (b) | (c) |
| (A) | (ii) | (iii) |
| (B) | (i) | (ii) |
| (C) | (ii) | (i) |
| (D) | (i) | (iii) |

Ans. (A) (ii) (iii) (i)

Ques. Match the items of the following two lists and suggest the correct code :

List-I

- (a) Zero Income Elasticity
- (b) Unit Cross Elasticity
- (c) Positive Cross Elasticity
- (d) Negative Cross Elasticity

List-II

- (i) Substitute goods
- (ii) Complementary goods
- (iii) Indifferent goods
- (iv) Independent goods

Codes :

(NTA UGC-NET Dec. 2014 P-II)

- | | | | |
|-----|-------|-------|------|
| (a) | (b) | (c) | (d) |
| (A) | (iii) | (ii) | (i) |
| (B) | (ii) | (iii) | (iv) |
| (C) | (iii) | (iv) | (i) |
| (D) | (iv) | (i) | (ii) |

Ans. (C) (iii) (iv) (i) (ii)

Ques. If price of any commodity decreases by 20% and the demand for that commodity increases by 40%, then elasticity of demand would be

(NTA UGC-NET Dec. 2012 P-III)

- (A) perfectly elastic
- (B) perfectly inelastic
- (C) unit elastic
- (D) highly elastic

Ans. (D) If price of any commodity decreases by 20% and the demand for that commodity increases by 40%, then elasticity of demand would be highly elastic.

Ques. A measure of the responsiveness of quantity demanded to changes in the price of a related good is known as

(NTA UGC-NET Dec. 2013 P-III)

- (A) Cross Elasticity of Demand
- (B) Substitution Elasticity of Demand
- (C) Complementary Elasticity of Demand
- (D) Price Elasticity of Demand

Ans. (A) The cross elasticity of demand is an economic concept that measures the responsiveness in the quantity demanded of one good when the price for another good changes. Also called cross-price elasticity of demand, this measurement is calculated by taking the percentage change in the quantity demanded of one good and dividing it by the percentage change in the price of the other good.